ESTIMATED GREATEST CARAPACE LENGTH AT MINIMUM LEGAL SIZE OF
ST. MATTHEW ISLAND BLUE KING CRABS

by

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INTRODUCTION

The minimum legal retention size of male blue king crabs *Paralithodes platypus* commercially fished in coastal waters of St. Matthew Island in the Bering Sea is described as 5.5 inches (139.7 mm) in carapace width (CW) in Alaska Department of Fish and Game Commercial Shellfish Fishing Regulations (ADF&G 1999). Establishing a relationship between CW and blue king crab overall body length, defined as greatest carapace length (GCL) and encompassing the distance from the rostrum to the posterior-most body margin, has importance for determining the appropriate dimension of commercial crab pot escape mechanism openings designed to inhibit bycatch of undersized males as well as female crabs. The objective of this investigation was to examine the relationship between CW and greatest GCW in a sample of males taken during the 1996 commercial fishery, and estimate true mean GCL at minimum legal size.

METHODS AND PROCEDURES

Greatest CL and CW for male blue king crabs were measured in September 1996 by at-sea observers deployed on catcher-processor vessels. Measurements of CW were taken to the nearest millimeter perpendicular to the medial axis at the point of maximum width; greatest CL was measured from the anterior tip of the rostrum to the posterior-most body margin, including protruding telson spines and other anatomical features. Linear regression using the ordinary least-squares (Neter et al. 1983) was used to fit the linear model,

$$\text{greatest CL} = \beta_o + \beta_1(\text{CW}) + \varepsilon$$

where the error, ε, is assumed normally distributed with a mean 0.

A $100(1-\alpha)\%$ confidence interval (CI) was estimated at the minimum legal size CW to examine the extent of variability in the linear model for the associated greatest CL

$$\beta_o + \beta_1(139.7) \pm t_{\alpha/2,n-2}\, S_{\beta_o + \beta_1}$$

where,
β_o = the estimated y intercept of the linear regression model;
β_1 = the estimated slope for the linear regression model;
CW = 139.7 mm (minimum legal size);
$t_{\alpha/2,n-2}$ = critical value of the *t* distribution at α and n-2 degrees of freedom and;
$S_{\beta_o + \beta_1}$ = the standard error of the unbiased estimator $\beta_o + \beta_1(139.7)$.

RESULTS AND DISCUSSION

A total of 279 male crabs between 87 and 191 mm GCL (and 79 mm to 172 mm CW) were randomly selected from pots fished daily during the 1996 season. Analysis of the data showed a strong linear relationship between male blue king crab CW and greatest CL with a 0.91 coefficient of determination (r^2) (Figure 1). Statistics from the regression model are given in Table 1. Based on the model output, the expected male king crab greatest CL at minimum legal size equaled 147.8 mm (5.8 in). Variability around true mean greatest CL at 95% CI ranged from 147.1 mm to 148.5 mm. The results of the analysis indicate that male blue king crab greatest CL is closely correlated to CW and the estimated true mean greatest CL of 147.8 mm can be used as a reliable estimator of minimum legal retention size for the commercial fishery.

LITERATURE CITED

ADF&G (Alaska Department of Fish and Game). 1997. Commercial Shellfish Fishing Regulations, 1997-98 edition. Commercial Fisheries Management and Development Division, Juneau.

Neter, J., W. Wasserman and M. H. Kutner. 1983. Applied Linear Regression Models. Richard D. Irwin Inc., Illinois. 537p.

Table 1.   Least squares regression analysis of greatest carapace length by carapace width (legal size) in male blue king crabs sampled during the 1996 St. Matthew Island commercial fishery.

Regression Statistics	
Correlation coefficient (r)	0.96
Coefficient of determination (r^2)	0.91
Adjusted r^2	0.91
Standard error	5.4 mm
mean greatest carapace length (CL)	139 mm
mean carapace width (CW)	130 mm
Sample size (n)	279

Linear model output

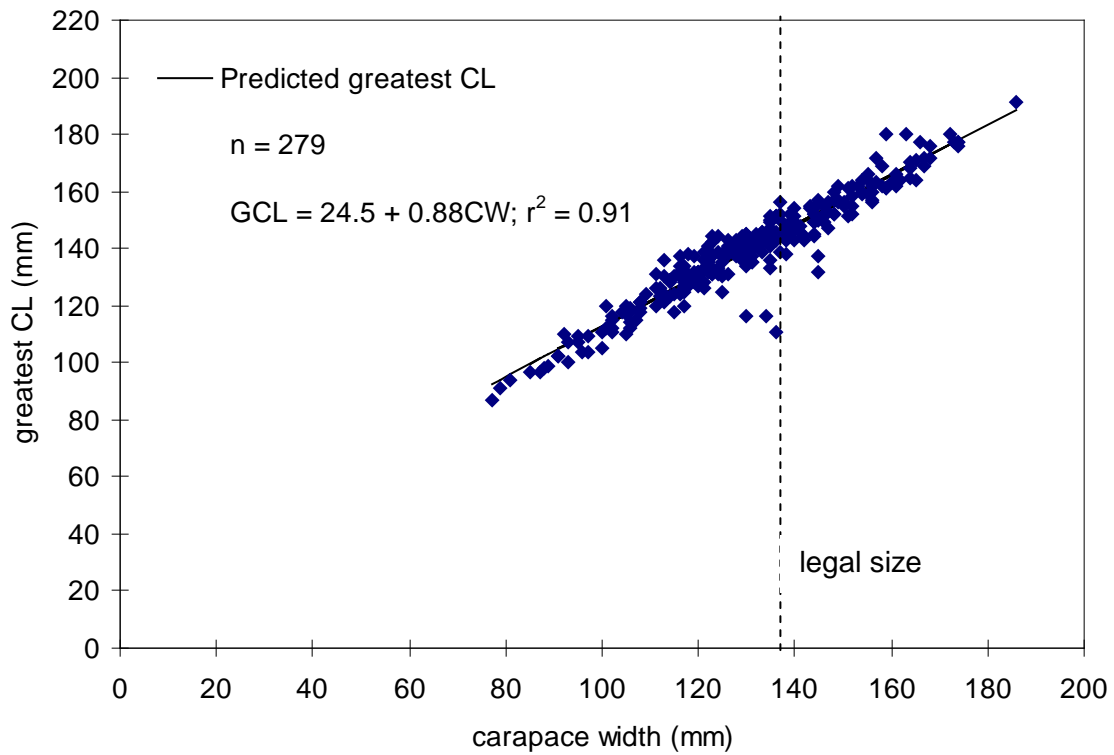|	Coefficients	Standard Error	P-value	Lower 95%	Upper 95%
Intercept	24.47	2.14	5.4E-25	20.25	28.70
Slope (carapace width)	0.88	0.02	2E-149	0.85	0.91

Figure 1. Observed and predicted greatest carapace length vs. carapace width in blue king crab males sampled during the 1996 St. Matthew Island commercial fishery.